Lighting Research Program

HID Electronic Ballast Testing

October 16, 2003

Funded by California Energy Commission's
Public Interest Energy Research (PIER) Program

Project 5.2: *Electronic HID Ballasts*

Product Performance Evaluation: *An evaluation of an emerging technology - electronic ballasts and controls for metal halide lamps.*

Possibilities

- Systems of 100W or below can be an energy efficient alternative to incandescent/halogen reflector lamps.
- Systems of 150W and above, if used with day light harvesting controls, can be an energy efficient improvement over the standard HPS and metal halide high bay lighting systems.
- Application of electronic ballasts could improve the performance of both metal halide and HPS lighting in outdoor applications.

5.2: HID Electronic Ballasts

Accomplishments To Date

- Tests are complete on ballasts for lamps 175W and below.
  - 6 ballast manufacturers have been tested
  - 96 lamp combinations have been tested
  - 70 different parameters are measured per lamp/ballast system
- The tests included measurement of lamp performance on an ANSI reference ballast, and of lamp and system performance on a commercial magnetic ballast.
- All lamps were aged for 100hrs and different lamp manufacturers were tested for a given wattage.

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Energy Saving Opportunities:

Improved Lamp and Ballast Efficiency: 175W and lower

- Small improvements in lamp performance were observed
- Ballast efficiency improved more significantly

Ballast Power Loss (W) / Lamp Wattage	39	50	70	100	150	175
Magnetic	14.6	15.9	18.6	24.9	35.5	37.6
Electronic	5.2	7.0	8.9	13.2	16.0	15.2
Savings	9.4	8.9	9.7	11.7	19.5	22.4
% Lamp Watts	24	18	14	12	13	13

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System performance was dependent on lamp manufacturer.

- Differences between quartz and ceramic arc tubes
- Differences between quartz arc tube lamps

Lamp #	Wattage	Ceramic/Quartz	Electronic Ballast Efficacy (Lumens/System Watts)	Magnetic Ballast Efficacy (Lumens/System Watts)	Reference Ballast Efficacy (Lumens/System Watts)
1	100	Ceramic	98.8	97.6	97.0
2	100	Quartz	99.6	95.3	93.9
3	100	Quartz	94.3	91.4	92.6
1	70	Ceramic	87.8	87.2	85.1
2	70	Quartz	79.2	76.4	76.9
3	70	Quartz	69.5	66.7	85.1

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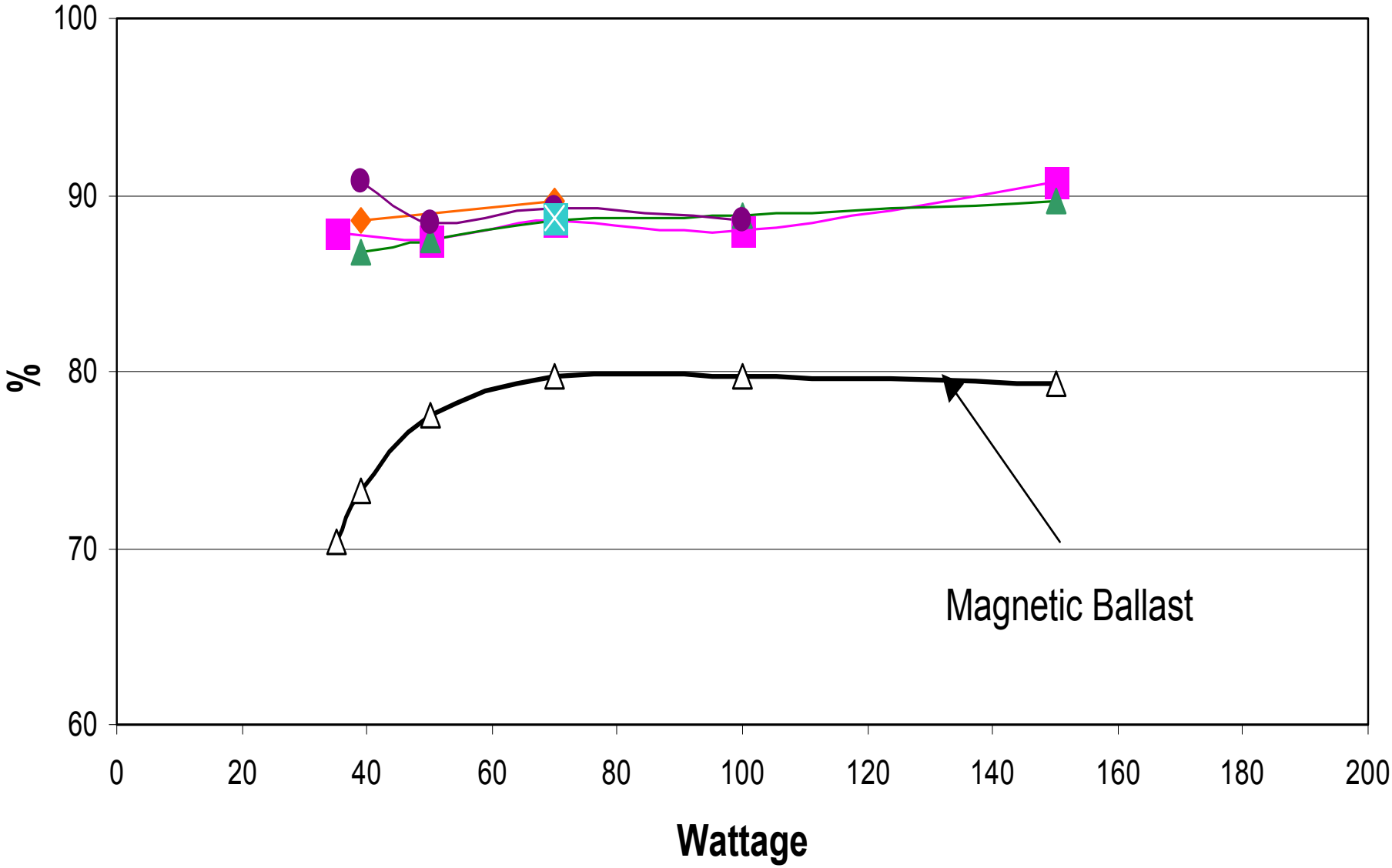
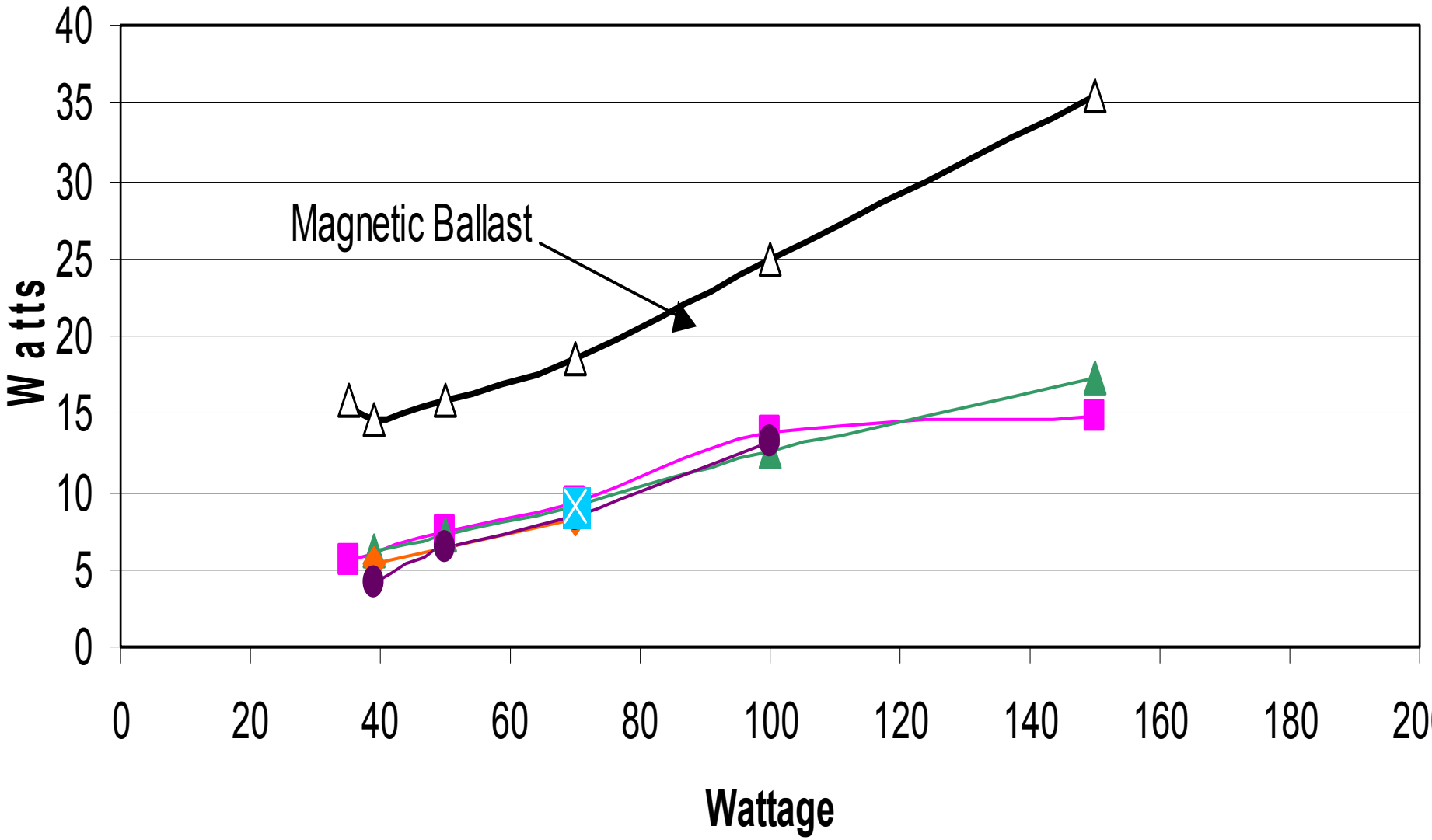
- There is no significant difference in the performance of the HID light source when operated by either magnetic or electronic ballasts, the improvement in system performance is realized in the higher efficiency of the electronic ballast over the magnetic ballast. The next two graphics illustrate this for operation of ceramic lamps.
  - The first graph demonstrates the electronic ballast is roughly 90% efficient at all wattages tested, meaning an additional 10% of the lamp wattage is lost in the ballast. The abscissa is the efficiency of the ballast and the ordinate is the wattage of the lamp tested. The different colors represent different manufacturers. The magnetic ballast is less efficient for the lower wattages but increases to 80% efficiency.
  - The second graph plots the watts consumed by the ballasts (abscissa) versus the lamp wattage (ordinate).

Ballast Efficiency - Ceramic Lamp



Power Loss - Ceramic Lamp



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Remaining Issues

- Despite manufacture's marketing claims, the technology is evolving on a monthly basis to improve product performance and reliability.
- Manufacturers continue to submit new models of products and new manufacturers ask to be included.
- Lifetest measurements will not be completed under this PIER work.

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Synergy with related activities at LBNL:

- Photometric and performance measurements of CA Military installations that are retrofitting existing day lit facilities with controllable metal halide electronic ballasts are being performed through a DOE/FEMP program.
- Important to help electronic ballast manufacturers improve their product through feedback on performance and to identify standards for the methods of measurement.
- Measurements on electronic ballasts for HPS lamps for outdoor parking area, security, and roadway applications are being conducted for the DOE/FEMP program and the City of Oakland.